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**Dataset Information:**

Funding\_Info: NOAA Climate Program Office  
Initial\_Submission: 20160130  
Revised\_Submission: 20160130

**Cruise Information:**

Experiment Name: LasC09-12  
Experiment Type: SOOP Line  
Platform Type: Ship  
Co2 Instrument Type: Equilibrator-IR or CRDS or GC

Cruise ID: 74X120120804  
Cruise Info: AOML\_SOOP\_CO2  
Geographical Region:

Westernmost Longitude: -75.2  
Easternmost Longitude: -62.4  
Northernmost Latitude: 21.1  
Southernmost Latitude: 11.1

**Cruise Dates (YYYYMMDD)**

Start\_Date: 20120804  
End\_Date: 20120807

**Ports of Call:**

Point Lisas, Trinidad and Tobago  
New Orleans, LA, USA

Vessel Name: M/V Las Cuevas  
Vessel ID: 74X1

Vessel Owner: Greenlight Transport S.A

**Variables Information:**

Variable Name: xCO2\_EQU\_ppm

Description of Variable: Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)

Unit of Variable: ppm

Variable Name: xCO2\_ATM\_ppm

Description of Variable: Mole fraction of CO2 measured in dry outside air (ppm)

Unit of Variable: ppm

Variable Name: xCO2\_ATM\_interpolated\_ppm

Description of Variable: Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2\_ATM analyses (ppm)

Unit of Variable: ppm

Variable Name: PRES\_EQU\_hPa

Description of Variable: Barometric pressure in the equilibrator headspace (hPa)

Unit of Variable: hPa

Variable Name: PRES\_ATM@SSP\_hPa

Description of Variable: Barometric pressure measured outside, corrected to sea level (hPa)

Unit of Variable: hPa

Variable Name: TEMP\_EQU\_C

Description of Variable: Water temperature in equilibrator (°C)

Unit of Variable: Degree C

Variable Name: SST\_C

Description of Variable: Sea surface temperature (°C)

Unit of Variable: Degree C

Variable Name: SAL\_permil

Description of Variable: Sea surface salinity on Practical Salinity Scale (o/oo)

Unit of Variable: ppt

Variable Name: fCO2\_SW@SST\_uatm

Description of Variable: Fugacity of CO2 in sea water at SST and 100% humidity (µatm)

Unit of Variable: µatm

Variable Name: fCO2\_ATM\_interpolated\_uatm

Description of Variable: Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)

Unit of Variable: µatm

Variable Name: dfCO2\_uatm

Description of Variable: Sea water fCO2 minus interpolated air fCO2 (µatm)

Unit of Variable: µatm

Variable Name: WOCE\_QC\_FLAG

Description of Variable: Quality control flag for fCO2 values (2=good, 3=questionable)

Unit of Variable: None

Variable Name: QC\_SUBFLAG

Description of Variable: Quality control subflag for fCO<sub>2</sub> values, provides explanation when QC flag=3

Unit of Variable: None

### Method Description:

#### Equilibrator Design:

Depth of Seawater Intake: 7 meters

Location of Seawater Intake: Sea chest under the engine room

Equilibrator Type: Spray head above dynamic pool, no thermal jacket

Equilibrator Volume: 0.95 L (0.4 L water, 0.55 L headspace)

Water Flow Rate: 1.5 - 2.0 L/min

Headspace Gas Flow Rate: 70 - 150 ml/min

Vented: Yes

Drying Method for CO<sub>2</sub> in Water:

Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).

Additional Information: Primary equilibrator is vented through a secondary equilibrator.

#### CO<sub>2</sub> in Marine Air:

Measurement: Yes, 5 readings in a group every 4.5 hours

Location and Height: On a mast above the bridge at ~20 meters above the sea surface

Drying Method:

Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).

#### CO<sub>2</sub> Sensor:

Measurement Method: IR

Manufacturer: LI-COR

Model: 840A

Frequency: Every 140 seconds, except during calibration

Resolution Water: ± 0.01 µatm in fCO<sub>2</sub>\_SW

Uncertainty Water: ± 2 µatm in fCO<sub>2</sub>\_SW

Resolution Air: ± 0.01 µatm in fCO<sub>2</sub>\_ATM

Uncertainty Air: ± 0.5 µatm in fCO<sub>2</sub>\_ATM

Manufacturer of Calibration Gas:

Std 1: CA03095, 247.01 ppm, owned by ESRL, used every ~4.5 hours. Std 2: CA03880, 318.94 ppm, owned by AOML, used every ~4.5 hours. Std 3: CA05979, 381.89 ppm, owned by AOML, used every ~4.5 hours. Std 4: CA06380, 448.29 ppm, owned by ESRL, used every ~4.5 hours.

Number of Non Zero Gas Standards: 4

#### CO<sub>2</sub> Sensor Calibration:

The analyzer is calibrated every ~4.5 hours using standards that are directly traceable to the WMO scale and using other field standards that in turn were calibrated with primary standards that are directly traceable to the WMO scale. Ultra-High Purity air (0.0 ppm CO<sub>2</sub>) and the high standard are used to zero and span the LI-COR analyzer.

#### Other Comments:

Instrument is located next to a walkway in the engine room. The space is not air-conditioned but the temperature is somewhat controlled by air vents.

#### Method References:

Pierrot, D., C. Neil, K. Sullivan, R. Castle, R. Wanninkhof, H. Lueger, T. Johannessen, A. Olsen, R.

A. Feely, and C. E. Cosca (2009), Recommendations for autonomous underway pCO<sub>2</sub> measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.

Details Co<sub>2</sub> Sensing:

details of CO<sub>2</sub> sensing (not required)

Measured Co<sub>2</sub> Params:

xco<sub>2</sub>(dry)

Sea Surface Temperature:

Location: In ship's engine room at a side port off the piping carrying cooling water for the engines. Between the sea chest and the side port there is ~5 meters of pipe (~0.25 diameter). During the transit, the seawater warms an estimated 0.2-0.5 deg C. The reported SST is the value measured at the side port.

Manufacturer: Seabird, Inc.

Model: SBE 38

Accuracy Degrees Celsius: 0.001

Precision Degrees Celsius: 0.0003

Calibration: Factory calibration

Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Equilibrator Temperature:

Location: Inserted into equilibrator ~5 cm below water level

Manufacturer: Hart

Model: 1521

Accuracy Degrees Celsius: 0.015

Precision Degrees Celsius: 0.001

Calibration: Factory calibration

Comments: Resolution is taken as Precision.

Equilibrator Pressure:

Location: Differential pressure reading from Setra 239 attached to the equilibrator headspace is added to the pressure reading from the LICOR, which limited the accuracy.

Manufacturer: LICOR

Model: none

Accuracy hPa: 15

Precision hPa: 1

Calibration: Factory calibration

Comments:

Manufacturer's Resolution is taken as Precision.

Atmospheric Pressure:

Location: On a mast above bridge at ~20 m above sea surface.

Manufacturer: Druck

Model: RPT350

Accuracy:  $\pm 0.08$  hPa

Precision: 0.01 hPa

Calibration: Factory calibration

Normalized: yes

Comments: Manufacturer's Resolution is taken as Precision.

Sea Surface Salinity:

Location: In the ship's engine room next to CO<sub>2</sub> system.

Manufacturer: Seabird

Model: SBE 45

Accuracy:  $\pm 0.005$  o/oo

Precision: 0.0002 o/oo

Calibration: Factory calibration

Comments: Manufacturer's Resolution is taken as Precision; Maintained by the SOOP group at AOML.

**Additional Information:**

Licor issue starting on JD 220. xCO<sub>2</sub>sw values are negative and show a lot of dispersion. All these data have been discarded. For the remaining data: H<sub>2</sub>O flow sensor still not working, atm P still shows swings of up to 15 mbar - Licor pressure was used instead. Standards are off but show similar behaviors. Probable issue with zero-span procedures. Original Data Location: [http://www.aoml.noaa.gov/ocd/gcc/lascuevas\\_introduction.php](http://www.aoml.noaa.gov/ocd/gcc/lascuevas_introduction.php)

**Preliminary Quality Control:**

NA

**Form Type:**

underway